SUPPLEMENT ANALYSIS

OF

COMPACTION OF LOW LEVEL WASTE
AND LOW LEVEL MIXED WASTE
IN THE RFP SUPERCOMPACTOR

DOE/EA-0432 SA-1

OCTOBER 1991

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1.0 Introduction and Background

This report is a supplement analysis (SA) prepared pursuant to the DOE guidelines in 52 FR 47667, Section C.2, December 15, 1987.

The Department of Energy intends to utilize a Supercompactor and Repackaging Facility at its Rocky Flats Plant to reduce the volume of Transuranic (TRU) Waste and TRU-mixed waste. The Department of Energy prepared an environmental assessment (DOE/EA-0432, July 1990) in order to assess the environmental impacts associated with construction and operation of a Supercompactor and Repackaging Facility, and a Transuranic Waste Shredder at its Rocky Flats Plant. The Department of Energy issued a Finding Of No Significant Impact (FONSI) for this environmental assessment on August 10, 1990.

TRU waste is waste material contaminated with alpha-emitting radionuclides that have atomic numbers greater than that of uranium (92), with half-lives greater than 20 years, and in concentrations greater than 100 nanocuries per gram. TRU-mixed waste is TRU waste that also contains hazardous constituents as defined by the Resource Conservation and Recovery Act (RCRA).

Low Level Waste is waste material having a concentration less than or equal to 100 nanocuries of alpha activity from transuranic elements per gram of waste. Transuranic elements have atomic numbers greater than 92 with half-lives greater than 20 years. Low Level Mixed Waste is LLW waste that also contains hazardous constituents as identified pursuant to the Resource Conservation and Recovery Act (RCRA). LLW and LLMW includes metals, combustibles (paper, cloth, coveralls, wood, plastics, rubber, etc.), glass, firebrick and other inorganic solids, solid laundry wastes, and sanitary waste from process areas, tools, equipment, components, and construction materials.

The Proposed Action, for which this report was prepared, is to utilize the Rocky Flats Plant Supercompactor and Repackaging Facility to reduce the volume of Low Level Waste (LLW) and Low Level Mixed Waste (LLMW). The Supercompactor and Repackaging Facility is located in Building 776 at the Rocky Flats Plant.

Approved Resource Conservation and Recovery Act interim status storage capacity is limited to 1509 cubic yards for LLMW. The Rocky Flats Plant imposed Limited Condition of Operation (LCO) is 1479 cubic yards. Currently, the actual RFP inventory is 1370 cubic yards. The Proposed Action is needed in order to reduce the volume of LLW and LLMW being stored on-site, in order to maintain compliance with the RCRA requirements until off-site waste storage and disposal sites are approved.

2.0 Purpose of the Supplement Analysis

The purpose of this SA is to provide a NEPA review of the compaction of Low Level Waste and Low Level Mixed Waste in the RFP Supercompactor to determine whether existing NEPA documents adequately define the environmental impacts of such activities at RFP.

This analysis contains information to facilitate a determination by DOE regarding the compaction of Low Level Waste and Low Level Mixed Waste in the

RFP Supercompactor and whether:

(i) The existing Environmental Assessment of Supercompactor and Repackaging Facility and TRU Waste Shredder, DOE/EA-0432, July 1990, (SARF EA) should be supplemented;

(ii) An Environmental Assessment for the Supercompaction of LLW/LLMW should be performed.

(iii) No further NEPA documentation is required.

3.0 Description of Proposed Action

The Proposed Action is to compact LLW and LLMW utilizing the RFP Supercompactor and Repackaging Facility (SARF). Utilization of the RFP Transuranic Waste Shredder is not proposed for the treatment of LLW/LLMW. Two categories of waste will be processed in the SARF; soft, or combustible waste, and hard, or noncombustible waste. Combustible wastes will include such items as paper, plastic and wood. Noncombustible wastes will include miscellaneous metals, piping, motors, glass, process filters, and high efficiency particulate air (HEPA) filters. The waste types will be separated into designated drums at the point of generation, and separation will be maintained throughout the waste management operations. Waste drums that are currently stored will be repackaged to ensure that the Nevada Test Site Waste Acceptance Criteria is met.

Hard wastes packaged in 35-gallon steel drums will be directly supercompacted (including the drum) into "pucks", and the pucks will be loaded into 55-gallon steel drums for final disposal. Bags of soft wastes, initially packaged in 55-gallon steel drums, will be unpackaged and precompacted into 35-gallon drums, and then the 35-gallon drums will be supercompacted. To achieve further volume reduction, process filters and HEPA filters may also be precompacted into 35-gallon drums and then supercompacted into pucks as hard wastes.

The SARF will require five operating personnel, and is expected to provide an average volume reduction of 5 to 1 and an average compacted density of 70 pounds per cubic foot.

4.0 Supercompactor and Repackaging Facility Process Description

The SARF will be used to process solid LLW and LLMW which are generated or have been generated during various operations at the Rocky Flats Plant. Currently, it is required that TRU and TRU-mixed wastes be batch-processed separately through the SARF to avoid cross-contaminating the TRU waste with hazardous waste. Similarly, this requirement will be imposed to prevent cross contaminating LLW with LLMW. In addition, TRU/TRU-mixed wastes and LLW/LLMW will be required to be batch-processed separately to prevent cross-contamination. A decontamination procedure to ensure that the waste streams are not cross-contaminated will be developed. The decontamination procedure will be reviewed by the Colorado Department of Health before supercompaction activities begin. The decontamination activities will be essentially the same as activities performed routinely at RFP to prepare for inventories and movement of equipment. It is anticipated that no further NEPA documentation is needed concerning the decontamination procedure.

All drums of LLW/LLMW will be scanned for the presence of free liquids by a Real Time Radiography (RTR) unit prior to being transported to the SARF. If free liquids above the limit are detected by the RTR unit, the drums will be returned to the generator for repackaging to eliminate free liquids.

All drums of LLW/LLMW which are to be compacted in the SARF unit will first be sent to one of several non-destructive assay (NDA) drum counters to determine the plutonium content of each drum. Administrative controls will be used to ensure that each drum entering the SARF does not exceed the established 100 nanocuries total radioactivity per gram of waste material limit for LLW/LLMW. All drums and their associated plutonium content will be logged prior to processing in the SARF. Drums will be arranged for processing according to the type of material contained, compatibility, and the maximum combined weight to be loaded, after compacting, into a single drum (not to exceed 800 pounds). Additionally, selection of drums for processing in the SARF will be based on the compactibility of the material contained; i.e., the expected height following compaction, in order to provide the most efficient packaging of the final drums, and therefore, maximize volume reduction.

The environmental impacts associated with Real Time Radiography and non-destructive assay have been analyzed in previous NEPA documentation, the Rocky Flats Plant Final Environmental Impact Statement (DOE/EIS-0064, April 1980).

The following activities associated with the compaction of LLW/LLMW are the same as those described for TRU/TRU-mixed wastes in the SARF EA. The detailed descriptions will not be reiterated in this supplement analysis.

- Hard Waste Entry into the SARF
- Soft Waste Entry and Precompaction
- Supercompaction
- Load Out

5.0 Repackaging and Supercompaction of Stored Wastes

Tables 1, 2, 3, and 4 present a breakdown of the current Low Level and Low Level Mixed Waste inventory as of July 1991. During the initial stored LLW/LLMW compaction campaign, an estimated 1963 cubic yards of LLW and 389 cubic yards of LLMW will be removed from storage, repackaged, and compacted concurrently with the normal waste production feed to the SARF. This repackaging effort is necessary to ensure that the loaded waste drums meet the NTS Waste Acceptance Criteria. Two categories of waste will be processed in the SARF; soft, or combustible waste, and hard, or noncombustible waste. Combustible wastes will include such items as paper, plastic and wood. Noncombustible wastes will include miscellaneous metals, piping, motors, glass, process filters, and high efficiency particulate air (HEPA) filters. The hard waste and soft waste repackaging will be conducted by personnel working in the Advanced Size Reduction Facility while wearing full-face mask respiratory protection. Currently, it is estimated that 557 (382 LLW + 175

~~LLMW) 55-gallon drums of double-bagged hard waste material will be manually~~ repackaged into 35-gallon drums. After repackaging, the drums containing hard waste will be compacted in the SARF.

Currently, it is estimated that 2709 (1315 LLW + 1394 LLMW) 55-gallon drums of soft waste will also be repackaged. Each drum will be repackaged, which includes removing the lid, and cutting the neck of the rigid liner to safely remove the bags of soft waste without damaging the integrity of the bags. After the bags of soft waste are removed, the rigid liner will be removed from the drum and will be disposed of as LLW. Bags of soft waste will then be placed back into the same or similar 55-gallon drum. After repackaging, drums of soft waste will be compacted in the SARF.

In addition, it is currently estimated that there will be 369.5 (363.5 LLW + 6 LLMW) plywood waste boxes (4 ft by 4 ft by 7 ft) and one (1) metal waste box containing LLW/LLMW that will also be repackaged and compacted. Each waste box will be placed in the Size Reduction Vault for the repackaging of the wastes. Personnel working in the Size Reduction Vault during the waste repackaging will be required to wear supplied breathing air suits. Soft waste will be manually removed from the waste box and will be repackaged into lined 55-gallon drums for subsequent compaction. Hard waste will also be manually removed from the waste boxes and will be repackaged into 35-gallon drums for compaction. After repackaging, the wastes will be compacted in the SARF.

Entrances to the Advanced Size Reduction Facility and the Size Reduction Vault are controlled by airlocks. Air pressure inside the two facilities is always kept at a negative pressure with respect to areas outside of these facilities so that airflow is always in the direction of increasing contamination. Air vented from these two facilities is routed to the existing glovebox ventilation control system in Building 776, where both are located. The air is filtered through four stages of HEPA filters in series prior to release to the atmosphere.

Currently, DOE is requesting for the Rocky Flats Plant approval from the Colorado Department of Health (CDH) to treat Low Level Mixed Waste in the Supercompactor and Repackaging Facility. Approval is not being requested for treatment of LLMW in the Transuranic Waste Shredder at this time. A request for change to interim status was submitted in October 1989 for approval to treat TRU-mixed wastes. As of this date, final approval to treat TRU-mixed wastes is contingent upon submittal of RFP Operating Procedures.

DOE is also requesting further changes to the interim status for the Rocky Flats Plant. Addition of the Size Reduction Vault (Unit 61) and the Advanced Size Reduction Facility (Unit 62) to the Low Level Mixed Waste Part A application is being requested. These units have always treated and/or stored LLMW in addition to TRU-mixed wastes, and it appears that there was an error of omission during the effort to create individual Part A applications for LLMW and TRU-mixed wastes. This request is specified in a DOE letter (91-DOE-5053) to CDH. CDH's approval is anticipated by November, 1991.
From the two preceding paragraphs, it seems that supercompaction of LLMW must be delayed until the CDH permits for treatment (supercompaction process) and repackaging are received.

6.0 Compacted LLW/LLMW Storage, Transport and Disposal

LLW/LLMW generated at RFP and processed by the SARF are proposed to be stored at RFP and disposed of at the NTS Radioactive Waste Management Site. NTS has specific procedures specifying waste preparation, packaging, and transportation from the Rocky Flats Plant to the NTS and for subsequent disposal of these wastes.

6.1 Storage

Room 134 in Building 776, also referred to as RCRA Unit 11, will be used for the staging of SARF drums before and after processing. Unit 11 is currently used for TRU/TRU-mixed wastes and it is proposed that LLW/LLMW also be stored there. Only the TRU-mixed waste and LLMW are RCRA regulated. Several other storage areas on plant site will be used for storage of LLW/LLMW compacted waste forms, in addition to storage of these wastes prior to compaction. These areas will primarily be RCRA interim status units because approximately 21 percent of the waste to be compacted will be LLMW. Of the 79 percent which is LLW, some portion will be stored in the RCRA units for convenience. The remaining portion of the LLW may be stored in other areas on plant site. The RCRA storage units which will be used for compacted LLMW and their associated capacities are listed in Table 7.

6.2 Transport

It is proposed that compacted LLW/LLMW be shipped to the Nevada Test Site's Radioactive Waste Management Site. The NTS is a DOE facility occupying nearly 3,500 square kilometers in southern Nevada, approximately 105 kilometers northwest of Las Vegas. The NTS serves as a principal disposal site for LLW generated by several DOE defense facilities and as a storage site for TRU wastes pending opening of the Waste Isolation Pilot Plant. Currently, the Area 5 Radioactive Waste Management Site at NTS encompasses approximately 732 acres which are used for the following purposes of concern:

- Emplacement of LLW generated by DOE facilities. Approximately 92 acres in the southeast corner of the Area 5 Radioactive Waste Management Site have been designated as the Low Level Waste Management Unit and have been developed for this use.

- Emplacement of Mixed Wastes generated by DOE facilities in two disposal cells within the Low Level Waste Management Unit.

DOE performed an Environmental Assessment of Mixed Waste Disposal Operations at the Nevada Test Site (DOE/EA-0461, March 1991) (NTS EA). To date, there has been no decision made concerning the significance of environmental impacts associated with this proposed action. Under the scope of this EA, the proposed action would continue for a period of five years, or up to a volume cap of 150,000 cubic meters, whichever occurs first. Transportation of Mixed Wastes from federal classified waste generators, such as RFP, was part of the scope of the EA. However, compacted mixed wastes was not part of the conducted analysis.

To date, it is unknown if the Nevada Test Site will accept a compacted mixed waste form. Appendix A presents the LLMW constituents utilized in the NTS EA. A comparison of the estimated LLW/LLMW constituents utilized in the NTS EA and the LLW/LLMW constituents submitted for the interim status change request was performed. It appears that Carbon Tetrachloride was not analyzed in the NTS EA. Table 10 is a LLW/LLMW characterization that recently was provided to the Colorado Department of Health. Carbon Tetrachloride is listed at an estimated maximum concentration of 15 ppm. Carbon Tetrachloride is listed a Probable Human Carcinogen by the Environmental Protection Agency. This means that there is sufficient evidence of carcinogenicity in animals but with inadequate (or lack of) human data. Table 11 of Appendix A is the mixed waste characterization utilized in the NTS EA. There are other Probable Human Carcinogens listed (such as Methylene Chloride), however, they are in the parts per billion concentration. The RFP estimated concentrations are in the parts per million range. Comparing the two waste characterizations, it is identified that the RFP maximum estimated concentrations for some chemicals are an order of magnitude or more than those used in the NTS EA analysis. It is concluded that the NTS EA does not provide a bounding case analysis for the transportation of RFP LLMW to NTS.

Additional comparison of RFP LLW constituents and NTS EA mixed wastes constituents, leads to the conclusion, that the NTS EA is not a bounding case analysis for the shipment of RFP LLW to the Nevada Test Site. Again, this conclusion is based upon the listed constituent concentrations being different by an order of magnitude or more. Currently, RFP is planning additional LLW/LLMW characterization efforts. It should be recognized that additional sampling analysis will tend to increase the maximum estimated concentrations listed in Table 10.

7.0 Potential Hazard Control

Potential Hazard Control associated with the compacting of TRU/TRU-mixed wastes are discussed in the SARF EA. The discussed potential hazard controls will mitigate potential environmental impacts of the compaction of TRU/TRU-mixed wastes. The analysis for potential hazard control for LLW/LLMW is similar to that discussed for the TRU/TRU-mixed wastes.

7.1 Fire Protection and Heat Dissipation

The Fire Protection and Heat Dissipation analysis provided in the SARF EA is applicable to the requirements for compacting LLW/LLMW. This conclusion is based upon the chemical constituent concentrations of LLW/LLMW being similar to those concentrations analyzed in the SARF EA.

Table 1: Low Level Mixed Soft Waste Inventory					
IDC	Description	55 Gal. Drums	Waste* Boxes	Estimated Drums	Total Drums
336	Combustibles Wet	13			13
851	Combustibles Dry	251			251
852	Combustible Wet	800	4	60	860
853	Combustible Plastic	159	2	30	189
861	Combustible Dry	2			2
TOTALS		1225	6	90	1315

Table 2: Low Level Mixed Hard Waste Inventory					
IDC	Description	55 Gal. Drums	Waste Boxes	Estimated Drums	Total Drums
440	Glass: Non-Raschig Rings	6			6
442	Raschig Rings, Leached	4			4
481	Light Metal Leached	1			1
488	Leaded Glovebox Parts	2			2
480	Light Metal	95			95
331	Fulflo Filter Not From Incinerator	3			3
335	Drybox Absolute Filters	25			25
338	Filter Media	16			16
490	Acid Contaminated	2			2
491	Plenum Filters	18			18
342	Absolute Drybox Filters	3			3
TOTALS		175	0	0	175

Table 3: Low Level Mixed Waste Inventory Cumulative Totals			
Description	55 Gal. Drums	Waste* Boxes	Cubic Yards
Soft LLMW	1225	6	339
Hard LLMW	175	0	50
TOTALS	1400	6	389

* Fifteen (15) 55-gallon drums per waste box.

Table 4: Low Level Soft Waste Inventory					
IDC	Description	55 Gal. Drums	Waste* Boxes	Estimated Drums	Total Drums
330	Dry Combustibles	58			58
337	Plastic	2			2
336	Combustibles Wet	6	1	15	21
831	Combustibles Dry		6	90	90
851	Combustibles Dry	2			2
861	Combustible Dry	626	277.5	4162.5	4788.5
862	Combustible Wet	557	12	180	737
863	Combustible Plastic	143	1.5	22.5	165.5
TOTALS		1394	298.0	4470.0	5864.0

Table 5: Low Level Hard Waste Inventory				
IDC	Description	55 Gal. Drums	Waste* Boxes	Metal Boxes
328	Fulflo Filter Incinerator	1		
331	Fulflo Filter Not From Incinerator	4		
335	Drybox Absolute Filters	2		
338	Filter Media	1		
342	Absolute Drybox Filters	8		
376	Processed Filter Media	10		
440	Glass: Non-Raschig Rings	26		1
442	Raschig Rings, Leached	76		
480	Light Metal	229	38.0	
490	HEPA Filters		27.5	
491	Plenum Filters	25		
TOTALS		382	65.5	1

Table 6: Low Level Waste Inventory Totals				
Description	55 Gal. Drums	Waste* Boxes	Metal Boxes	Cubic Yards
Soft LLW	1394	298.0	0	1583
Hard LLW	382	65.5	1	380
TOTALS	1776	363.5	1	1963

* Fifteen (15) 55-gallon drums per waste box.

Table 7: RCRA Storage Units for Supercompacted LLMW					
Unit No.	Building	Room	No. of Drums	Cubic Yards	
11	776	134	555	151	(300 total)(1)
12	776	237	183	50	
15	904	PAD	1102	300	
20	664	ALL	7033	1913	(2500 total)(1)

Note:
(1) These Areas are Permitted for LLMW as well as TRU-Mixed Waste.

7.2 SARF Operation to Prevent Criticality

The SARF process could bring fissile moderating materials closer together, therefore, it is necessary to ensure that this process will be operated in a criticality safe manner. Criticality concerns of compacting LLW/LLMW in the SARF have been evaluated by the RFP Nuclear Criticality Engineering Department. Criticality concerns will be mitigated if the waste drums are certified to be LLW/LLMW, i.e, not above 100 nanocuries total radioactivity per gram waste material. Based upon the compacted waste density in the drums of 70 pounds per cubic feet, the actinide content would be less than 4 grams per drum. All drums of LLW/LLMW which are to be compacted in the SARF will first be sent to one of several non-destructive assay (NDA) drum counters to determine the plutonium content of each drum. Administrative controls will be used to ensure that each drum entering the SARF is not above the 100 nanocuries total radioactivity per gram waste material limit. Utilization of these controls, will enable the SARF EA analysis to be a bounding case analysis concerning LLW/LLMW criticality.

7.3 Nuclear Criticality Safety During Storage

The supercompacted LLW/LLMW will be stored in LLMW RCRA Permitted Storage Units. The only limit that may be required concerns the stacking height of the drums. Since there is no obvious way to distinguish between LLW/LLMW and TRU/TRU-mixed waste drums, stacking height would be limited to what is currently allowed in the specific area. For example, if a limit existed for 200 gram drums to be stacked two drums high in one area, the compacted LLW/LLMW drums would also be limited to two high to prevent mixing the drums and over-stacking the 200 gram drums. Otherwise no stacking limit would be imposed upon the compacted LLW/LLMW drums.

7.4 Nuclear Criticality Safety During Transportation

Nuclear Material Safety limits will be need to be established for the transport vehicle used for transporting the compacted LLW/LLMW. This would result in establishing how many drums of waste could be transported per shipment, the stacking height, etc. These limits will be required as part of the Safety Analysis Report for Packaging (SARP) needed to satisfy Department of Transportation requirements prior to shipment.

7.5 Nuclear Criticality Safety in Repository

Criticality safety at NTS would need to be analyzed. Criticality safety in the WIPP repository for TRU/TRU-mixed wastes has been analyzed in the WIPP FEIS and WIPP SEIS. This analysis demonstrated that a maximum fissile loading per drum of 200 fissile gram equivalents of Pu-239 precludes the possibility of a criticality event in the repository. It was determined that the assumptions used in this analysis were sufficiently conservative to bound the waste matrix conditions produced by supercompaction of TRU/TRU-mixed wastes. However, to date it is unknown if these assumptions would be bounding for the LLW/LLMW compaction. It is anticipated that there may be more moderator and reflector material in the LLW/LLMW drums of waste.

The Environmental Assessment of Mixed Waste Disposal Operations at the Nevada Test Site (DOE/EA-0461, March 1991), based upon NVO-325, *Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements* dated October 1988, requires that for nuclear safety the quantity of fissile materials within a package shall be limited so that an infinite array of such packages will remain subcritical. This quantity shall be determined on the basis of a specific nuclear safety analysis, considering credible accident situations, and shall take into account the actual materials in the waste. (See 49 CFR 173.451, "Fissile Materials - General Requirements"). These are Department of Transportation requirements for Mixed Waste and Low Level Waste Packaging. It appears that an analysis for the repository needs to be performed prior to shipment of supercompacted LLW/LLMW to NTS. A copy of NVO-325 is provided as Appendix B.

7.6 Waste Compatibility

LLW/LLMW will be collected, stored and packaged in order to meet the NTS Waste Acceptance Criteria for disposal of wastes at the NTS Radioactive Waste Management Unit. A copy of the NTS Waste Acceptance Criteria (NVO-325) is presented in Appendix B. While some repackaging of solid wastes occurs at RFP, much of the waste is placed in drums or crates and sealed at the point of generation. The waste characterization procedures and process knowledge provide the operator with the information needed to avoid mixing incompatible wastes. The procedures necessary to implement the above assurances have been approved at RFP. However, they currently are only implemented in Building 559. Implementation of these procedures is occurring in a phased implementation approach. It is anticipated that total implementation will occur by January, 1992. It is recommended that LLW/LLMW to be compacted meet the NTS WAC prior to compaction, to ensure that there is no need to repackage any supercompacted LLW/LLMW.

Compatibilities for LLMW being treated in the SARF are determined using 6 CFR Part 264, Appendix V. Rather than using the Waste Form Number (WFN) as is the case for TRU/TRU-mixed waste in the Environmental Assessment of Supercompactor and Repackaging Facility and TRU Waste Shredder (DOE/EA-0432, July 1990), Item Description Codes (IDCs) are used for identifying LLW compatibility. Item Description Codes are grouped in a way which is similar to the WFN format used. Compatibility groups and codes are listed in Table 8. The IDCs for LLMW proposed for treatment in the SARF and their corresponding compatibility codes are summarized in Table 9. Table 10 lists the Low Level Waste IDCs proposed for treatment in the SARF, their hazardous constituents and the estimated maximum concentrations. Tables 8, 9, 10 are based on information submitted to the Colorado Department of Health requesting a change to interim status to allow treatment of LLMW in the SARF, Unit 74.

8.0 ENVIRONMENTAL IMPACTS AND IMPACT MITIGATION

Operation of the SARF to compact LLW/LLMW will occur in Building 776 and should have no significant adverse impacts with respect to regulatory compliance. Wetlands, threatened or endangered species, and historical, prehistorical, and archaeological resources will not be affected by the Proposed Action. A RCRA permit will be obtained to treat Low Level Mixed Wastes by the SARF, and compliance with this permit will be maintained.

A comparison of the proposed LLW/LLMW waste characterization and that utilized in the SARF EA was performed. The two waste characterizations are very similar, however, the LLW/LLMW contains several chemicals and metals that are not identified in the TRU/TRU-mixed waste characterization. These are Cadmium (10 ppm), Chromium (20 ppm), Silver (390 ppm), Xylene (10 ppm), Methyl Alcohol (5 ppm), Butyl Alcohol (5 ppm), Toluene (23 ppm) and Methyl Ethyl Ketone (7 ppm). Chromium (VI) is a Group A Human Carcinogen as identified by the Environmental Protection Agency. Currently, the Chromium listed is identified as total Chromium. Thus any risk assessment would conservatively consider the Chromium concentration to be Chromium (VI). Another waste of concern is Mercury. The SARF EA identified an estimated maximum concentration of 0.77 ppm. However, the proposed LLW/LLMW characterization identifies an estimated maximum concentration of 51 ppm. This is almost a difference of two orders of magnitude. Therefore, it is concluded that the SARF EA analysis does not provide a bounding case analysis for non-radioactive emissions to the environment. However, it can be concluded that implementation of the Proposed Action will create no detectable increases in radioactive emissions to the existing environment above that concluded in the SARF EA. This is concluded since TRU/TRU-mixed waste by definition contains a greater concentration of radioactivity. Therefore, it is recommended that additional analysis be conducted to determined if operation of the SARF to compact LLW/LLMW will affect compliance with NAAQS and the Clean Air Act.

8.1 Air Quality

Glovebox effluents will be filtered through four stages of high efficiency particulate air (HEPA) filters before being discharged to the atmosphere. Each of these filters is able to be penetration tested with dioctylphthalate (DOP) to assure particulate removal efficiency. Particulate air samplers, similar to SAAMs, will continuously monitor these effluents for increases in airborne alpha activity. These monitors will alarm if significant increases in airborne alpha activity are detected. The HEPA-filtered air effluent will be continuously sampled using fixed samplers that will be changed twice each week. Filters collected from the fixed samplers will be analyzed for non-specific alpha emitters and for the specific radioisotopes of plutonium, americium and uranium. The series staged HEPA filters will maintain the radionuclide air concentrations below 0.02 picocuries per cubic meter. If emissions of non-specific alpha emitters exceed 0.02 pCi/m^3, an investigation will be conducted to determine the cause(s) and the corrective action that will be taken.

The Colorado Department of Health (CDH) requires submittals of an Air Pollution Emission Notice (APEN) for vents at RFP releasing significant amounts of hazardous, criteria, or toxic air pollutants. Hazardous air pollutants are asbestos, beryllium, mercury, vinyl chloride, lead, hydrogen sulfide, and benzene. Criteria air pollutants are carbon monoxide, lead, nitrogen oxides, sulfur oxides, ozone and particulate matter less than ten microns. Other reportable air pollutants are particulates and volatile organic compounds which may react photochemically in the atmosphere to form ozone. RFP prepared a technical report, *Air Pollution Emission Notices; Supercompactor and Repackaging Facility and Transuranic Waste Shredder* dated October 1990, as an attachment to the Air Pollution Emission Notice (APEN) and permit application for the SARF and TWS. This document furnishes supporting information for estimated airborne releases, controlled and uncontrolled, of non-radiological regulated materials that may occur from operations of this equipment. The APEN was based upon the waste characterization in the SARF EA.

Comparing the waste characterization identified for LLW/LLMW (Table 10) to the waste characterization identified for TRU/TRU-mixed wastes (Table 13), it appears that the LLW/LLMW characterization contains additional constituents that were not addressed in the Air Pollution Emission Notice. These constituents are Cadmium, Chromium, Silver, Acetone, Xylene, Methyl Alcohol, Butyl Alcohol, Toluene, and Methyl Ethyl Ketone. Currently, the Chromium (20 ppm) listed is identified as total chromium. Thus any assessment would conservatively consider the Chromium concentration to be Chromium (VI). Another waste of concern is Mercury. The SARF EA identified an estimated maximum concentration of 0.77 ppm. However, the proposed LLW/LLMW characterization identifies an estimated maximum concentration of 51 ppm. This is almost a difference of two orders of magnitude. Prior to supercompaction of LLW/LLMW it appears that a similar APEN analysis estimating airborne releases, controlled or uncontrolled, of non-radiological regulated materials that may occur from operations of the SARF, should be performed. This analysis should address if previous emission estimates are maximized with the additional waste streams being treated in the supercompactor. For example, if the previous APEN analysis assumed that 1.92E10 milligrams/year was the emission estimate from the TRU/TRU-mixed waste, now with the inclusion of the LLW/LLMW, the emission estimate may increase to 1.92E14. An increase could occur, since the supercompactor will operate more hours per year, if LLW/LLMW is compacted in addition to TRU/TRU-mixed waste.

Table 8: Compatibility Groups and Codes	
Code	Group
1A	Basic sludge/solution
1B	Acidic sludge/solution
2A	Reactive metals/hydrides
3A	Water/alcohols
4A	Organics
5A	Cyanides/sulfides
6A	Oxidizer

Table 9: IDCs Proposed for Supercompaction and Their Compatibility Codes

IDC	Description	Remarks
330,336,337, 851,852,853	Combustible Waste	Compatibility codes are assigned are 3A due to water content (not free liquid) and 4A for plastics and traces of halogenated organic solvents.
480,481	Metal Waste	Compatibility codes assigned are 4A due to traces of halogenated organic solvents and 2A for packages containing aluminum and/or beryllium.
440,442	Glass Waste	Compatibility code assigned is 4A due to trace levels of organic solvents.
335,490,491	Filter Waste	Compatibility code assigned is 3A due to water content (not free liquid).
325	Mixed IDCs	Compatibility codes assigned may be any of the following: 1A, 1B, 2A, 3A, 4A, 5A, and 6A. Since this IDC covers miscellaneous waste types, any of the above codes may apply depending upon the type(s) of waste present in the drum.

Table 10: Low Level Wastes Proposed for Treatment In The SARF

IDC	Waste Description	Hazardous Constituents	Estimated Maximum Concentration
330,851	Dry Combustibles	1,1,1 Trichloroethane	2000 ppm
336,852	Wet Combustibles	Carbon Tetrachloride	750 ppm
337,853	Plastic	1,1,2 Trichloro-1,2,2 Trifluoroethane	1500 ppm
		Methylene Chloride	750 ppm
480	Light Metal	1,1,1 Trichloroethane	15 ppm
481	Light Metal, Leached	Carbon Tetrachloride	10 ppm
		1,1,2, Trichloro-1,2,2 Trifluoroethane	75 ppm
		Methylene Chloride	200 ppm
		Lead	17 %
440	Glass, Except Raschig Rings	None	
442	Raschig Rings, Leached	None	
335	Absolute Dry Box Filters	1,1,1 Trichloroethane	400 ppm
490	HEPA Filters	Carbon Tetrachloride	400 ppm
491	Plenum Prefilters	1,1,2 Trichloro-1,2,2 Trifluoroethane	150 ppm
		Methylene Chloride	50 ppm
325	Mixed IDCs RCRA Mixed Waste	Cadmium	10 ppm
		Chromium	20 ppm
		Lead	10 ppm
		Mercury	51 ppm
		Silver	390 ppm
		Carbon Tetrachloride	15 ppm
		1,1,1 Trichloroethane	190 ppm
		1,1,2 Trichloro-1,2,2 Trifluoroethane	20 ppm
		Methylene Chloride	5 ppm
		Acetone	13 ppm
		Xylene	10 ppm
		Methyl Alcohol	5 ppm
		Butyl Alcohol	5 ppm
		Toluene	23 ppm
		Methyl Ethyl Ketone	7 ppm

Note: IDCs 440 and 442 contain no hazardous constituents and are therefore classified as LLW, not as LLMW.

The air pathway is the primary potential route for radiological and hazardous chemical dispersion to the workers and public. The potential radiological impacts to workers and the public from the Proposed Action are bound by the results and conclusions presented in the Environmental Assessment of Supercompactor and Repackaging Facility and TRU Waste Shredder (DOE/EA-0432, July 1990). The evaluation of the hazardous chemical impacts in the SARF EA was based on very conservative assumptions. It was assumed that all of the volatile organics, and one percent of the metals in the waste to be processed, were released to the glovebox exhaust systems.

Actual emissions and impacts from routine operations of the SARF are expected to be much less than the values specified in the EA. Operation of the SARF to compact LLW/LLMW will not produce significant quantities of gaseous or particulate air pollutants. As discussed above, the LLW/LLMW characterization is not identical to the TRU/TRU-mixed waste characterization. A comparison of the proposed LLW/LLMW waste characterization and the TRU/TRU-mixed waste characterization utilized in the SARF EA was performed. The two waste characterizations are very similar, however, the LLW/LLMW contains several chemicals and metals that are not identified in the TRU/TRU-mixed waste characterization. These are Cadmium (10 ppm), Chromium (20 ppm), Silver (390 ppm), Xylene (10 ppm), Methyl Alcohol (5 ppm), Butyl Alcohol (5 ppm), Toluene (23 ppm) and Methyl Ethyl Ketone (7 ppm). Chromium (VI) is a Group A Human Carcinogen as identified by the Environmental Protection Agency. Currently, the Chromium concentration identified is total Chromium. Thus any risk assessment would conservatively identify the Chromium concentration as Chromium (VI). Another waste of concern is Mercury. The SARF EA identified an estimated maximum concentration of 0.77 ppm. However, the proposed LLW/LLMW characterization identifies an estimated maximum concentration of 51 ppm. This is almost a difference of two orders of magnitude. Therefore, it is concluded that the SARF EA analysis does not provide a bounding case analysis for non-radioactive exposure analysis to the workers and public. It is recommended that a quantitative assessment be performed that includes the above reservations.

New RCRA Organic Air Emission Standards (Subparts AA and BB of 40 CFR Parts 265 and 264) pertaining to certain types of process equipment do not apply to the SARF. However, newly proposed regulations (Subpart CC) will apply to Organic Air Emissions from waste containers. This is a plantwide concern which is currently being addressed by RFP RCRA Permitting.

8.2 Water Quality

Operation of the SARF to compact LLW/LLMW will not require any significant quantities of water or produce wastewater. In the SARF process, hydraulic fluid used by the precompactor and supercompactor will be cooled by water circulating through a heat exchanger. After the cooling water has passed through the heat exchanger, the water will be recycled and reused on-site or the water will be disposed of by evaporation. Water circulating through the heat exchanger will not come in contact with or be contaminated by the LLW/LLMW. During operation of the supercompactor, small quantities of liquid may be compressed from the waste. This liquid will be collected and pumped to an existing annular tank in the Advanced Size Reduction Facility for waste treatment and disposal. Supercompacted waste products will be stored where they will be monitored to detect any leakage of contamination or impacts to surface water or ground water. All drums of LLW/LLMW will be scanned for the presence of free liquids by a Real Time Radiography (RTR) unit prior to being transported to the SARF. If free liquids above the limit are detected by the RTR unit, the drums will be returned to the generator for repackaging to eliminate free liquids. This administrative control is similar to that concerning TRU/TRU-mixed wastes analyzed in the SARF EA. Therefore, the SARF EA is a bounding case analysis for water quality impact from the supercompaction of LLW/LLMW. The Proposed Action will not create wastewater effluents or discharges that will impact compliance with the Clean Water Act.

8.3 Gas Generation from Supercompaction

Gas generation has been evaluated for RFP waste handling and management operations. The potential impacts identified are an explosion hazard from buildup of hydrogen gas or from pressurization of the waste container.

There are three mechanisms by which gas may be generated within the drums of supercompacted LLW/LLMW: radiolytic gas generation, chemical reaction, and bacterial degradation. A number of different parameters exist for measuring this gas generation, including total gas generation potential, actual gas generation, and rate of gas generation.

All wastes to be accepted at the Mixed Waste Management Unit (MWMU) at NTS are packaged solids which are not flammable in the solid state. Free liquids, bulk solids, or unpackaged material will not be accepted. Material packaging must conform to the requirements of Title 49 CFR and NVO-325. To ensure that waste material deposited in the MWMU shallow land disposal cells satisfy the above criteria, wastes are sampled before shipment and tested to certify compliance with NVO-325 waste acceptance criteria. Wastes will be pretreated prior to shipment to the NTS MWMU to stabilize gases, eliminate liquid content, and prevent bacterial action in any organic material that may be present. For these reasons, plus the frequent inspections of container integrity prior to final land burial, the possibility of gas generation resulting in heat generation, fire, explosion, was determined to be negligible in the NTS EA. This analysis was for LLMW and was primarily concerned with chemical reactions associated with the waste.

Supercompaction will mix and rearrange materials and bring them into closer proximity. This will not increase the total gas generation potential because it creates no new waste materials for reaction. However, supercompaction may change gas generation rates and the percentage of the total gas generation potential which actually occurs. Such changes will be the result of proximity changes among the reactants involved in the various gas generation mechanisms.

The SARF EA analyzed the potential for gas generation associated with TRU/TRU-mixed wastes. The analysis included a postulated accident scenario due to gas generation. This analysis also relied upon a mitigative action such as requiring drums to be equipped with a carbon-composite filter to permit venting of gases while retaining radioactive material. Risks associated with gas generation were subsequently determined to be insignificant. There are no plans to develop a program for testing drums of LLW/LLMW for gas generation. Gas generation due to radiolytic reactions in LLW/LLMW will be far less than that seen in TRU/TRU-mixed waste due to lower radioactive content of the waste. Nevertheless, the safety concerns associated with potential gas generation will be mitigated by the same mechanisms which are used for TRU/TRU-mixed wastes. These include the use of carbon composite filters and the environmentally controlled storage of waste containers. Therefore, the gas generation in LLW/LLMW analysis is bounded by the results and conclusions reached in the SARF EA addressing TRU/TRU-mixed wastes.

8.4 Personnel Exposure

Radiological exposures to workers and the public from the compaction of LLW/LLMW can occur due to routine operations and potential accidents. Radiological exposures from compaction of TRU/TRU-mixed wastes were analyzed in the SARF EA. Since TRU/TRU-mixed wastes contain a higher plutonium concentration than LLW/LLMW, the radiological exposures associated with compaction of LLW/LLMW, from routine operations and potential accident scenarios, are bound by the conclusions and results in the Environmental Assessment of Supercompactor and Repackaging Facility and TRU Waste Shredder (DOE/EA-0432, July 1990).

However, it is recognized that the hazardous chemical constituents of the LLW/LLMW may differ in elements and quantities than that for TRU/TRU-mixed wastes. A comparison of the proposed LLW/LLMW waste characterization and the TRU/TRU-mixed waste characterization utilized in the SARF EA was performed. The two waste characterizations are very similar, however, the LLW/LLMW contains several chemicals and metals that are not identified in the TRU/TRU-mixed waste characterization. These are Cadmium (10 ppm), Chromium (20 ppm), Silver (390 ppm), Xylene (10 ppm), Methyl Alcohol (5 ppm), Butyl Alcohol (5 ppm), Toluene (23 ppm) and Methyl Ethyl Ketone (7 ppm). Chromium (VI) is a Group A Human Carcinogen as identified by the Environmental Protection Agency. Currently, the Chromium concentration is identified as total Chromium. Thus any risk assessment would conservatively identify the Chromium concentration as Chromium (VI). Another waste of concern is Mercury. The SARF EA identified an estimated maximum concentration of 0.77 ppm. However, the proposed LLW/LLMW characterization identifies an estimated maximum concentration of 51 ppm. This is almost a difference of two orders of magnitude. Therefore, it is concluded that the SARF EA analysis does not provide a bounding case analysis for non-radioactive exposure analysis to the workers and public. It is recommended that a quantitative assessment be performed that includes the above reservations.

8.5 Storage

Room 134 in Building 776, also referred to as RCRA Unit 11, will be used for the staging of drums before and after compaction. Several other storage areas on plant site, as identified in Table 7, will be used for storage of drums of compacted LLMW only. LLW will be stored elsewhere on plant site.

Waste compatibility within each storage unit will be achieved through compliance with established RCRA compatibility procedures. Each drum of waste to be compacted in the SARF will either contain a single IDC, or a group of IDCs which are compatible. Each final drum of supercompacted LLW/LLMW will likewise contain compatible IDCs. Following compaction in the SARF, the final drum will have all of the waste IDCs which were fed to the unit. None of the input IDCs will be changed and no new IDCs will be produced. The final drums of compacted LLW/LLMW will be stored in storage areas which will be authorized to receive the particular IDCs in the drums in order to avoid incompatibility problems.

Fissile material loading in each compacted drum and in each storage area is determined by the RFP Nuclear Criticality Engineering Department. Criticality concerns of compacting LLW/LLMW in the SARF have been evaluated by the RFP Nuclear Criticality Engineering Department. Criticality concerns will be mitigated by the waste drums being certified to be LLW/LLMW, i.e, not above 100 nanocuries total radioactivity per gram waste material. Based upon the compacted waste density in the drums of 70 pounds per cubic feet, the actinide content will therefore be less than 4 grams per drum.

All drums of LLW/LLMW which are to be compacted in the SARF will first be sent to one of several non-destructive assay (NDA) drum counters to determine the plutonium content of each drum. Administrative controls will be used to ensure that each drum entering the SARF is not above the 100 nanocuries total radioactivity per gram waste material limit.

The maximum supercompacted drum weight will be limited to 800 pounds per drum, which is the current limit for any waste form. Therefore, supercompacted LLW/LLMW will not alter the current waste management weight-related issues such as floor loading or waste stacking.

Drums of supercompacted LLW/LLMW may or may not have a higher rate of gas generation than non-compacted waste, as discussed in Section 8.3. In any case, all drums will be vented by carbon composite filters and all storage areas will be provided with adequate ventilation, such that gases (particularly hydrogen) are not expected to build up to significant levels. This does not require any change from current operations.

The impacts associated with the maximum credible accident for the various RCRA storage units have been evaluated taking supercompacted LLW/LLMW into consideration. The radiological impacts associated with this proposed action are bound by the analysis and conclusions presented for TRU/TRU-mixed wastes in the SARF EA. As discussed above, it is recognized that the hazardous chemical constituents of the LLW/LLMW differ in elements and quantities than that for TRU/TRU-mixed wastes. It is recommended that a quantitative assessment of the maximum credible accident for the proposed LLW/LLMW for supercompaction be performed.

8.6 Transportation

Potential transportation impacts may result from the nature of the cargo (radioactive and hazardous wastes) being shipped or from those normally incident to transportation, which include latent effects associated with vehicle pollution and traumatic injuries and fatalities from accidents. Human health impacts associated with the cargo being shipped may result from routine exposure during transit (e.g., external radiation) or from release of radioactive and hazardous wastes due to an accident.

Normal transportation is associated with incremental pollution from engine emissions, fugitive dust generation in the vehicle's wake, and particulates from tire wear. Uncertainties are associated with pollution emission rates and atmospheric dispersion behavior. The Proposed Action will involve on-site and off-site transportation activities.

8.6.1 Expected On-Site Transportation Impacts

Operation of the SARF to compact LLW/LLMW will not alter existing on-site traffic patterns for the movement of LLW/LLMW. Hard and soft wastes currently repackaged from drums to boxes in the Size Reduction Vault in Building 776 will continue to be processed within the same building. It is anticipated that the increased on-site LLW/LLMW transportation activities from waste generators to Building 776 will be small.

Transport and handling of waste will be conducted in compliance with the On-site Transportation Manual. Emergency response procedures for accidents are described in Section 17 of the manual. Drivers of vehicles carrying hazardous material or waste are trained according to the driving and parking rules of the Department of Transportation, RCRA, and the RFP Health, Safety and Environment requirements. LLW/LLMW are transported on plant site over paved roads which are well marked with traffic and safety signs to promote safe transport.

From the above, it is concluded that on-site transportation risks associated with the Proposed Action will remain substantially the same as current waste management practices. Therefore, the analysis presented in the SARF EA is a bounding analysis for the On-Site Transportation impacts for LLW/LLMW.

8.6.2 Expected Off-Site Transportation Impacts

It is proposed that supercompacted LLW/LLMW will be shipped to NTS for emplacement in underground storage. This section evaluates the expected impacts on the human environment resulting from transportation of supercompacted LLW/LLMW from RFP to NTS.

The SARF EA determined that the off-site transportation of supercompacted TRU/TRU-mixed wastes to the Waste Isolation Pilot Plant incurs risks comparable to or lower than those associated with non-supercompacted waste forms. Although supercompaction will result in higher quantities of radioactive material per shipment, the number of shipments will decrease proportionately for a given volume of waste.

Analysis of the NTS EA indicates that the estimate of transportation and disposal risks did not include supercompacted LLW/LLMW. Appendix AIII and AVII of the NTS EA describe in detail the assumptions that were used to estimate the risks of transportation. An analysis similar to that performed in the SARF EA may be necessary to determine if the risks associated with transporting supercompacted LLW/LLMW are comparable to those risks determined in the NTS EA. In addition, the NTS EA waste characterization did not include Carbon Tetrachloride, which is a probable carcinogen. The RFP LLW/LLMW waste characterization includes Carbon Tetrachloride. Other constituents that are identified with the RFP LLW/LLMW characterization, but were not identified in the NTS EA waste characterization, are silver, chromium, Methyl Alcohol, Butyl Alcohol, and Methyl Ethyl Ketone. Comparing the two waste characterizations, it is identified that the RFP maximum estimated concentrations for some chemicals are an order of magnitude or more than those used in the NTS EA analysis. It is concluded that the NTS EA does not provide a bounding case analysis for the transportation of RFP LLMW to NTS. Detailed discussion is presented in Section 6.2.

8.7 Disposal

The final waste forms produced by the SARF must meet the NTS Waste Acceptance Criteria in order to be acceptable for disposal at NTS. For routine operations, the total mass of radionuclides shipped to NTS will not be changed by supercompaction. Although supercompaction could result in waste drums with a higher surface dose rate for external radiation, the number of drums will decrease. Handling time will decrease in direct proportion to the decrease in the number of drums such that the total exposure will remain comparable; i.e., a higher dose rate for a shorter time will yield the same total exposure. It is noted that the supercompacted waste form will also have some additional self shielding benefit from increased waste density. The supercompacted waste form must meet the NTS-WAC limit of 200 mrem/hr for contact handled waste.

Currently, it is unknown if the Nevada Test Site will accept supercompacted waste. The NTS EA did not address supercompacted waste forms. Criticality safety at NTS would also need to be analyzed. The NTS EA, based upon NVO-325, *Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements* dated October 1988, requires that for nuclear safety the quantity of fissile materials within a package shall be limited so that an infinite array of such packages will remain subcritical. This quantity shall be determined on the basis of a specific nuclear safety analysis, considering credible accident situations, and shall take into account the actual materials in the waste. (See 49 CFR 173.451, "Fissile Materials - General Requirements"). These are Department of Transportation requirements for Mixed Waste and Low Level Waste Packaging. It appears that an analysis for the repository needs to be performed prior to shipment of supercompacted LLW/LLMW to NTS. A copy of NVO-325 is provided as Appendix B.

8.8 Cumulative Impacts

Operation of the SARF to compact LLW/LLMW will lead to a significant decrease in volume of solid waste stored at RFP. Therefore, the cumulative effect on the volume of solid waste stored at and shipped from RFP will be beneficial.

As discussed above, the NTS EA LLMW and the proposed RFP LLW/LLMW waste characterizations are different. Air emissions of chemicals from routine supercompaction of LLW/MMLW will need to be quantitatively assessed. It is expected that most particulates generated during waste compaction are expected to be captured by the HEPA filters in the building exhaust plenum, and will not have any measurable impact at the plant boundary.

Liquids generated during supercompaction will be collected in a 4-liter tank and transferred through existing process piping to an existing tank near the Advanced Size Reduction Facility for plutonium. These liquids will be similar to other liquid wastes generated at RFP that are treated in Building 374. Although the amount of liquid waste generated by the supercompaction process is unknown, it is projected to be minimal due to the RTR waste screening process for free liquids prior to processing in the SARF. Assuming a conservative waste processing rate of 10,000 drums per year, and assuming an overly conservative one quart of liquid collect per drum, the total amount of liquid collected will be 2,500 gallons per year. The cumulative impact on the current liquid waste treatment facility in Building 374 is therefore expected to be insignificant in relation to the current 16 to 20 million gallons of liquid treated annually.

9.0 Conclusions

It is our conclusion that the existing NEPA environmental impact analysis does not adequately address the compaction of LLW/LLMW in the RFP Supercompactor. The analysis necessary to ensure adequate NEPA documentation is consistent with that contained in an Environmental Assessment. Further analysis and additional administrative activities must be performed in order to document and support the conclusions of this analysis. These analyzes and administrative activities include:

- A decontamination procedure to ensure that the waste streams are not cross-contaminated must be developed. The decontamination procedure will be reviewed by the CDH before supercompaction activities begin.

- Rocky Flats Plant must obtain approval from the Colorado Department of Health to treat Low Level Mixed Waste in the Supercompactor and Repackaging Facility. Currently, a request is pending for CDH approval for the Rocky Flats Plant to treat Low Level Mixed Waste in the Supercompactor and Repackaging Facility. Approval is not being requested for treatment of LLMW in the Transuranic Waste Shredder at this time.

- A change to the interim status for the Rocky Flats Plant must be obtained. Addition of the Size Reduction Vault (Unit 61) and the Advanced Size Reduction Facility (Unit 62) to the Low Level Mixed Waste Part A application must be obtained. These units have always treated and/or stored LLMW in addition to TRU-mixed wastes, and it appears that there was an error of omission during the effort to create individual Part A applications for LLMW and TRU-mixed wastes. This request is specified in a DOE letter (91-DOE-5053) to the Colorado Department of Health (CDH). CDH's approval is anticipated by November, 1991.

- Confirmation must be obtained from the Nevada Test Site to accept a compacted mixed waste form, if it is intended to use the NTS for storage.

- Nuclear Material Safety limits will need to be established for transportation of the supercompacted LLW/LLMW. These limits will be required as part of the Safety Analysis Report for Packaging (SARP) needed to satisfy DOT requirements prior to shipment.

- A Nuclear Material Safety Criticality Analysis for the repository needs to be performed prior to shipment of supercompacted LLW/LLMW to NTS.

- LLW/LLMW to be supercompacted must meet the NTS WAC. Waste characterization procedures and process knowledge provide the operator with the information needed to avoid mixing incompatible wastes. The procedures necessary to implement the above assurances have been approved at RFP. However, they currently are implemented only in Building 559. Implementation of these procedures is occurring in a phased implementation approach. It is anticipated that total implementation will occur by January, 1992. It should be ensured that there is no need to repackage any supercompacted LLW/LLMW.

- Prior to supercompaction of LLW/LLMW, an APEN analysis estimating airborne releases, controlled or uncontrolled, of non-radiological regulated materials that may occur from operations of the SARF needs to be performed. This analysis should address if previous emission estimates for TRU/TRU-mixed wastes are maximized with the additional waste streams being treated in the supercompactor.

- The LLW/LLMW hazardous chemical constituent characterization is not identical to the TRU/TRU-mixed waste characterization. It is concluded that the SARF EA is not a bounding scenario for the LLW/LLMW hazardous chemical analysis. It is recommended that a bounding case analysis for LLW/LLMW hazardous chemical analysis be initiated.

- Comparing the two waste characterizations (NTS EA and RFP LLW/LLMW), it is identified that the RFP maximum estimated concentrations for some chemicals are an order of magnitude or more than those used in the NTS EA analysis. It is concluded that the NTS EA does not provide a bounding case analysis for the transportation of RFP LLMW to NTS. This conclusion is for supercompacted LLMW and non-supercompacted LLMW. It is recommended that a bounding case analysis for transportation of Low Level Waste and Low Level Mixed Waste be initiated.

APPENDIX A

SOURCE TERMS

FOR

ROCKY FLATS PLANT
AND
NEVADA TEST SITE

In this Appendix, the Source Term for the LLW/LLMW currently stored at RFP and the Source Term used for the Environmental Assessment of Mixed Waste Disposal Operations at the Nevada Test Site (DOE/EA-0461, March 1991) will be compared. It is possible that the source term for the NTS EA may be useful as a bounding analysis for the Proposed Action.

1.0 Nevada Test Site Mixed Waste Source Term

An appendix documents the source term analysis conducted for the LLW/LLMW forms for postulated accident conditions. The source term calculations determine the quantity of radioactive material released in a respirable, airborne form, following an accident. Larger particle sizes(greater than 10 um mean aerodynamic diameter) are not analyzed since they tend to be eliminated by the body and consequently are insignificant in estimating health effects. The magnitude to the source term will be affected by the amount of material-at-risk in the accident, the accident conditions (e.g., intensity and duration of fire, impact energy), the radioactive material release mechanisms, and the level of confinement retained by the waste containers or building structure.

In the Environmental Assessment of Mixed Waste Disposal Operations at the Nevada Test Site (DOE/EA-0461, March 1991), the DOE proposed to expand the Mixed Waste Management Unit (MWMU). In order to estimate the transportation and disposal operation risks associated with this facility, the analyses was based on a series of assumptions:

(A) The selection of the waste generators to be analyzed. The waste generators selected for the transportation risk analysis were the Rocky Flats Plant, Sandia National Laboratory, Nevada Test Site and DOE/Federal Classified Waste. Additionally, mixed waste from Lawrence Livermore National Laboratory was evaluated for its particular waste characteristics.

(B) The waste volumes. A Department of Energy Memorandum dated June 12, 1990, states that the proposed Mixed Waste Disposal Facility at NTS would have a volume cap of 150,000 m^3. Additionally, the Memorandum stated that only a five year operating time period would be evaluated. A total waste volume of 58,558 m^3 of mixed wastes is currently in storage or will be generated by the above listed waste generators.

(C) The waste characteristics and radiological source term used for the transportation risks analysis. Waste forms from the generators are summarized below:

- Production facilities such as RFP typically produce sludges that are the products of liquid waste treatment facilities. These wastes are evaporated and the residue is immobilized by the addition of cement. These wastes are contaminated with low levels of americium, plutonium and uranium. They are also contaminated with halogenated and non-halogenated solvents.

- Combustible waste consisting of materials such as paper, Kimwipes, Texwipes, solvent-containing rags, cling-free cloths, general cleaning material, wood, plastic chips, plastic, supplied air suits, bath towels, gloves, and gauze is also produced at production facilities. The materials are contaminated with low levels of americium, plutonium, and uranium. They are also contaminated with halogenated and non-halogenated solvents, some used in the degreasing operations in the manufacturing process. Depending on the operations which generate combustibles, the waste stream composition is varied.

- Production facilities produce metal waste consisting primarily of lead shielding and leaded glass used in routine operations in the plutonium analytical laboratories, plutonium development and recovery operations, manufacturing, assembly, and product support areas. Gloves used in glovebox operations are not included in this waste stream. This material is contaminated with low levels of plutonium or uranium.

- Research facilities generate metal wastes which include depleted uranium wastes generated from weapons programs component testing at research facilities. Wastes are solid and include weapon pieces, contaminated soil, and decontamination debris. Waste generation is variable and project specific. Waste is generated from various weapons tests including drop tests, compaction studies, heat stress studies, and explosive tests.

- Also included are activated wastes from weapons-related accelerator programs. Wastes are generated by activation of metals from accelerators and in the future will include tritium-contaminated wastes.

- Other metal wastes are radiation and miscellaneous sources and debris from the irradiation facilities. This waste includes Cs^{137} and Co^{60} radiation sources and miscellaneous calibration standards, or check standards. Debris such as lead shielded transport containers is associated with these wastes. Generated waste forms include dry solids, filters, resins, and waste waters; however, wastes in their final form will be stabilized solids.

- Classified metal wastes are generated by federal facilities and consist primarily of depleted uranium from weapons component testing. Wastes are solids and include weapon pieces and contaminated debris. Other metals include lead and beryllium.

This waste characterization data was consolidated into two idealized waste forms for purposes of performing a bounding transportation analysis for this EA. These two waste forms were immobilized sludges and combustible waste, and contaminated metals. When possible, bounding source terms were assigned to each of these wastes based on an examination of specific waste stream characterization data sheets. When insufficient concentration data existed for individual radionuclides, values were assigned from CFR 49 173.431 (Activity Limits for Type A Packages).

(D) The number of waste shipments and the origin of the waste shipments. The transportation risks were bounded based on the following assumptions:

- 144,337 m^3 of waste will be transported and 150,000 m^3 will be disposed.
- All waste will be shipped in 2′ x 4′ x 7′ half boxes (1.6 m^3) and 16 half boxes will constitute a waste shipment.
- 25.6 m^3 of waste will be transported per waste shipment.
- 144,047 m^3 from off-site mixed waste generators will require 5,628 shipments.
- In order to conservatively bound the transportation risks, all waste shipments will originate from RFP and the Defense Waste Consolidation Facility located at Barnwell, South Carolina.
- 1,014 of the off-site waste shipments will originate from RFP.
- 4,614 of the off-site waste shipments will originate from the Defense Waste Consolidation Facility in South Carolina.

(E) The hazardous chemical source terms. A listing of hazardous chemical constituents in mixed waste intended for disposal at NTS in the next five years is presented in Table 11. This table is based on the Waste Characterization Data Sheets supplied by the Rocky Flats Plant, Nevada Test Site and Sandia National Laboratory.

The volatile organic compounds (VOCs), in the form of spent solvents, and degreasers, and the heavy metals associated with the mixed waste designated for NTS are similar in nature and concentration to the hazardous constituents contained in transuranic (TRU) waste. This is understandable since many of the same processes that produced mixed TRU waste at DOE defense sites also create LLMW. For this reason, the EA used the same methodology for assessing the consequences of hazardous chemical exposures as was used in the Waste Isolation Pilot Plant SEIS.

The VOCs examined in this assessment are methylene chloride, 1,1,1-trichloroethane, 1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon-113) and Trichloroethylene. In wastes, these chemicals are the EPA-regulated hazardous components that may potentially comprise greater than one percent by weight of the waste transported to NTS and are considered hazardous by the EPA (40 CFR Part 261, Subparts C and D). All others are estimated to comprise less than one percent each by weight of the waste, and most exist only in trace quantities. Initial concentrations of VOCs in the mixed wastes are derived from data on the headspace gas concentrations of TRU waste.

Metals examined in the transportation risk analysis include lead, cadmium, mercury, and beryllium. Lead is the most abundant metal found in the waste by both weight and volume because the waste includes both lead particulates and pieces of metals (shielding bricks, lined gloves, aprons). Mixed wastes to be shipped to NTS for disposal from a DOE production or research facility could have as much as 550 kgs of lead per box.

Table 11: Hazardous Constituents in Mixed Wastes Shipments to NTS.

Constituent	Range of Concentrations (ug/L)	Average Concentration (ug/L)
Volatile Organics:		
Acetone	130 - 6,800	2,000
2-Butanone	130 - 7,300	3,715
Chloroform	29 - 620	297
1,1-Dichloroethane	N/A	53
1,2-Dichloropropane	N/A	73
Ethylbenzene	N/A	410
Methylene Chloride	120 - 2,400	883
Toluene	32 - 750	286
1,1,1-Trichloroethane	N/A	3,700
Trichlorofluoroethane	N/A	61
Trichlorofluoromethane	N/A	340
1,1,2-Trichloro-1,2,2 -Trifluoroethane	130 - 3,800	2,043
Xylenes (Total)	15 - 18,000	3,937
Metals:		
Beryllium (particulate)		10 ppm
Cadmium		390 ppm
Lead (particulate)		200 ppm
Lead (metal)		344 kg/m^3
Mercury		50 ppm
Arsenic		Trace
Lithium		Trace

1.1 Chemical Hazards

The EPA Health Effects Assessment Summary Tables were utilized to identify chemical species having either carcinogenic or noncarcinogenic effects. Of the chemical constituents listed, several are not listed or unit risk values have not been determined for the inhalation pathway (2-Butane, Ethylbenzene, Trichlorofluoroethane, 1,2-Dichloropropane). Cadmium is classified as a probable human carcinogen, with limited evidence of carcinogenicity in humans. Chloroform is also classified as a probable human carcinogen; however, while their is sufficient evidence of carcinogenicity in animals, there is lack of evidence in humans. Methylene chloride is also of interest because it is considered a potential carcinogen by the EPA. 1,1,1-Trichlorethane and Freon-113 might produce adverse health effects. Lead is one of the most abundant metals found in the waste by both weight and volume. In sufficient concentrations, exposure to lead has been found to cause damage to the central nervous system and loss of kidney function.

During incident-free transportation of mixed wastes to NTS, the hazardous chemical constituents of this waste will present no exposure risk. This is due to the fact that 1) the waste is contained in Type A containers which are constructed so that they will not leak during normal transportation and handling conditions; 2) the initial concentration of these wastes are low; and 3) the physical form of the waste further limits the concentration available for release.

In transportation accidents, the nature of hazardous chemical exposures is due to the accident release mechanisms. For this analysis a transportation accident scenario was postulated to determine the potential releases of VOCs and metals. The scenario assumes that a shipment of 16 half-boxes of combustible/non-combustible waste is involved in an impact and subsequent fire. All 16 boxes are involved in the fire with the result that the total amount of VOCs calculated to be in the box are released. The initial concentrations of VOCs of concern, and the estimated quantities released to the atmosphere during the accident, are presented in Table 12. These quantities were used to estimate release rates and potential receptor concentrations (50 meters from the accident site) assuming stable meteorologic conditions.

With regard to hazardous metals, it was assumed that particulates of lead, cadmium, beryllium and mercury and chunks of lead (shielding, bricks, gloves, aprons) and beryllium may be present in the noncombustible fraction of the mixed waste. For the transportation accident analysis, a shipment of 16 half boxes of 50/50 combustible/noncombustible waste was assumed to be impacted and burned in a 1 hour fire. While the open burning of hydrocarbon fuels creates a flame temperature of approximately 1800F, the thermal inertia of 16 boxes, convection mitigating mechanisms, air starvation due to accident debris and fumes, and the likely evaporation of fuel and the debris before it burns all contribute to lower the average temperature of the event; for this analysis, a temperature of 1000F was assumed. Releases of respirable particulates in this accident scenario can occur by the following mechanisms: 1) impact release of particulate fractions, 2) thermal entrainment of particulate fractions not released by impact, 3) thermal release of vapors from particulate fractions or metal chunks. Respirable particulates constitute 1% of the particulate fractions (per NVO-325 WAC) and it was assumed that 1% of thermally released particles would be of respirable size. Impact releases and thermal entrainment of metallic particles were analyzed using the release fractions for radioactive particulates from noncombustible fractions of mixed waste.

To calculate vapor releases, partial pressures of metallic vapors at 1000F over unlimited metal sources were determined. These partial pressures were used to calculate vapor concentrations and resulting source terms assuming the vapors were released from an area source (top surfaces of 16 burning boxes) with a wind speed of 2 meters/second for 1 hour.

The source term for each species (or the total grams available in the waste if this quantity was limiting) was used to estimate a respirable emission rate and resulting air concentration at a location near the accident.

Table 12: Primary Volatile Organic Compound Concentrations of Mixed Waste

Hazardous Constituent	Avg. Headspace Gas Concentration (g/m^3)	Release (g)[2]
Methylene Chloride	0.5	12.9
1,1,1-Trichloroethane	13.2	334.9
Trichloroethylene	0.7	17.8
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.2	30.4

(1) Based on TRU drum measurements at INEL.
(2) Assumes headspace gas concentration applied to 16 boxes of combustible/noncombustible waste.

2.0 SARF EA Hazardous Constituents Source Term

In the SARF EA it was identified that TRU/TRU-mixed wastes would be collected, stored, and packaged in compliance with the WIPP Waste Acceptance Criteria (WAC). These criteria specify specific waste forms that have been determined to be compatible within each waste form number and suitable for disposal at the proposed WIPP facility in New Mexico. RFP uses two waste classification systems. The Item Description Code (IDC) identifies the physical and chemical form of all TRU material at RFP. IDCs are used to assure materials accountability throughout the plant. The second classification system in use at RFP is the waste form number (WFN). This system was developed as a tool for certifying that wastes meet the WIPP WAC. The WFN classification system is only used for solid wastes. The IDCs are grouped into one of thirteen WFNs based on chemical and physical form. The chemical compatibility of IDCs in a given WFN is based on information contained in 40 CFR Part 264, Appendix V.

Table 13 lists the TRU-mixed Waste Form Numbers for the SARF and TWS that will be stored on-site and then shipped off-site. The hazardous constituents and the maximum concentration in each WFN are also listed. It is unlikely that any drum of waste will contain each hazardous constituent at the levels shown in Table 13.

Table 13: Transuranic Mixed Waste Forms Analyzed in SARF EA

WFN	Waste Form Name	Hazardous [a] Constituents	Maximum [a] Concentration	IDC	IDC Description
116	TRU Combustible Waste	1,1,1 Trichloroethane	2000 ppm	330,831	Combustibles Dry
		Carbon Tetrachloride	750 ppm	336,832	Combustibles Wet
		1,1,2-Trichloro-1,2,2 -Trifluoroethane	1500 ppm	337,833	Plastic
		Methylene Chloride	750 ppm		
117	TRU Metal Waste	1,1,1 Trichloroethane	15 ppm	480	Light Metal
		Carbon Tetrachloride	10 ppm	481	Light Metal-Leached
		1,1,2-Trichloro-1,2,2 -Trifluoroethane	75 ppm	488	Glovebox Parts with Lead
		Methylene Chloride	200 ppm		
		Lead	100 %		
118	TRU Glass Waste	1,1,1 Trichloroethane	1 ppm	443	Raschig Rings
		Carbon Tetrachloride	1 ppm	444	Glass:Leaded,Ground
		1,1,2-Trichloro-1,2,2 -Trifluoroethane	1 ppm		
		Methylene Chloride	1 ppm		
		Lead	9 ppm		
		Mercury	0.77 ppm		
119	TRU Filter Waste	1,1,1 Trichloroethane	150 ppm	328	Filter,Fulflo from 771 Incinerator
		Carbon Tetrachloride	150 ppm		
		1,1,2-Trichloro-1,2,2 -Trifluoroethane	100 ppm	335	Absolute Dry Box
				376	Filter Media
		Methylene Chloride	50 ppm	338	
				490	HEPA Filters
				491	Plenum Prefilters

Note:
(a) Established by RFP based on process knowledge.

APPENDIX B

NEVADA TEST SITE

NVO-325